

REPORTS on the MARINE BIOLOGY of the SUDANESE RED SEA.—XI. Notes on a Collection of Nudibranchs from the Red Sea. By Sir CHARLES ELIOT, K.C.M.G., Vice-Chancellor of the University of Sheffield. (Communicated by Prof. W. A. HERDMAN, F.R.S., F.L.S.)

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THE Nudibranchs here described were collected mostly by Mr. C. Crossland, but partly also by Mr. J. G. Logan at Suez and in the neighbourhood of Suakin. The collection, though in many respects typical of the Indo-Pacific area, presents several points of interest. The large flat forms (*Discodoris*, *Platydoris*, etc.), which are generally so abundant on these shores, are poorly represented, probably because their favourite habitat (the underside of large stones on reefs) did not occur in the collecting-grounds. The presence of *Goniodoris castanea* and *Lomanotus vermiformis* (which may be the young of the Mediterranean species *L. genei*) is very remarkable, and the question arises whether they are part of the original fauna of the Red Sea or importations through the Suez Canal. Nudibranchs more than most molluscs have a fondness for adhering to the bottoms of ships and probably make considerable journeys in this way. On the other hand, *Thecacera maculata*, Eliot, which is recorded from Karachi (Eliot, in Journ. of Conchol. 1905, p. 242), is hardly distinguishable from *Th. pennigera*, which is only known from the British Coast, and the distribution of *Lomanotus* and *Goniodoris* may perhaps prove to be similar.

The reappearance of *Ohola pacifica*, *Thorunna furtiva*, and *Plocamopherus ocellatus* is also interesting. These curious forms have hitherto been known only by the descriptions of scanty alcoholic material or by the brief account of Leuckart (1828).

I have registered seven new species with considerable hesitation. It is possible that none of them are really new forms, but the characters of the specimens as preserved do not agree with those formulated for any recognized species. *Lomanotus vermiformis* and *Pleuroleura glabra* are perhaps immature. *Artachæa verrucosa* and *Peronodoris denticulata* are very like Bergh's *A. rubida* and *Peronodoris cancellata*, but differ in their dentition. *Kentrodoris labialis* is perhaps identical with Pease's *Doris setosa*, but is certainly different from the species of *Kentrodoris* described by Bergh, and does not entirely agree with the characters of the genus as formulated by him, since it has a labial armature. But it agrees even less with the characters of the only alternative genus, *Audura*, a form with a labial armature which offers some resemblance to *Kentrodoris*. It therefore seems necessary either to create a new genus for its reception, or to refer it to *Kentrodoris*. I have

adopted the latter course. Species possessing a labial armature are found in genera which are defined as being without this feature (e. g., *Platydoris* and *Staurodoris*); and though strong plates or real jaws are an important character, the difference between a labial cuticle with a vestigial armature and one which is totally unarmed is very small and does not necessarily entail other structural differences.

Very curious are the specimens of *Doridopsis rubra*, in which, as testified by the notes on the living animals as well as by the condition of the preserved specimens, the pockets of the rhinophores and branchiæ have almost disappeared, causing those appendages to become practically non-retractile.

The list of species is as follows :—

1. PLEUROLEURA GLABRA, sp. nov.
2. LOMANOTUS VERMIFORMIS, sp. nov.
3. CROSSLANDIA FUSCA, Eliot.
4. MELIBE BUCEPHALA, Bergh.
5. ÆOLIDIELLA ORIENTALIS, Bergh.
6. ELYSIA GRANDIFOLIA, Kelaart.
7. HEXABRANCHUS SANGUINEUS (Rüppell & Leuckart).
8. NEMBROTHA LIMACIFORMIS, sp. nov.
9. TREVELYANA STRIATA, sp. nov.
10. OHOLA PACIFICA, Bergh.
11. PLOCAMOPHERUS OCELLATUS, Leuckart.
12. GONIODORIS CASTANEA, Alder & Hancock.
13. CHROMODORIS DIARDII (Kelaart).
14. CHR. QUADRICOLOR, Rüppell.
15. CHR. MACULOSA, Pease.
16. CHR. PALLIDA (Rüppell & Leuckart).
17. CHR. INORNATA, Pease.
18. THORUNNA FURTIVA, Bergh.
19. PLATYDORIS INCERTA (?), juv., Eliot.
20. DISCODORIS AMBOINENSIS (?), juv., Bergh.
21. KENTRODORIS LABIALIS, sp. nov.
22. PERONODORIS DENTICULATA, sp. nov.
23. ASTERONOTUS HEMPRICHI, Ehrenberg.
24. ARTACHÆA CLAVATA, Eliot.
25. ARTACHÆA VERRUCOSA, sp. nov.
26. DORIDOPSIS RUBRA (Kelaart).
27. DORIDOPSIS NIGRA (Stimpson).
28. DORIDOPSIS sp.
29. PHYLLIDIA VARICOSA, Lamarek.
30. MARIONIA CYANOBRANCHIATA (Rüppell & Leuckart).

## PLEUROLEURA GLABRA, sp. nov.

? = *Pl. ornata*, juv. (For the genus see Eliot: "Nudibranchs of Southern India and Ceylon," Proc. Zool. Soc. 1906, p. 676, ff.)

The only notes are: "Khor Dongola; nudibranch; no gills. White with grey mottlings. Eyes halfway up rhinophores."

The preserved specimen is 10 mm. long and 4.3 broad. Its back is mottled with various shades, both light and dark, of grey and greyish green. A row of small black spots runs along the line of junction between the mantle-margin and the sides of the body, and there are others on the sides of the foot.

The general shape is as usual in the genus, but the back is quite smooth and bears no ridges or tubercles. The rhinophores are entirely retracted into distinct holes about 1 mm. apart. The dorsal surface passes through them into the frontal shield without interruption. There is a row of pores (apparently cnidopores) on the mantle-edge; most of them are set in white spots.

The jaws are yellow and the edge bears several rows of longish denticles, which are more than a mere mosaic and become more numerous on the lower part of the jaws. The formula of the radula for the longest rows is  $28 \times 18 + 5 + 1 + I + 1 + 5 + 18$ . The central tooth has a long cusp and about 11 distinct denticles on either side. The first lateral looks rather like half the central tooth and bears 7 distinct denticles on the outer side. The next five teeth gradually assume the ordinary hamate shape, and like the first lateral bear 7 denticles on the outer side. The remaining teeth vary from 16 to 18 in number, and in the majority of rows are only 16. They are hamate and quite smooth, no denticles being found beyond the sixth tooth from the rachis. The outermost teeth are smaller and slenderer than the rest.

In order to preserve the single specimen the other organs were not examined.

Ten species of *Pleuroleura* have been described, but the present specimen does not seem to belong to any of them. It is possible that it may be a young specimen of *Pl. ornata*, which has a tuberculate back, a broader radula, and more numerous denticles on the central tooth. Provisionally I describe it as a new species, the principal characters being the dentition and the smoothness of the dorsal surface.

## LOMANOTUS VERMIFORMIS, sp. nov.

(See for the genus, Eliot: "Notes on some British Nudibranchs," Journ. Marine Biol. Assoc. vii. 1906, p. 348, ff.)

The notes on the living animal are as follows:—"Engineer Island, Khor Dongola. A diver brought a large plumularian hydroid from among coral

on the reef from which I took many specimens of a small Tritonid. They are elongated with a tapering tail, the body being almost vermiform and does not contract on killing. The cerata are remarkably small. The colour black with specks of white which are especially aggregated in two bands along the sides of the back. Cerata translucent with white tips."

Forty-five specimens are preserved. The largest are 8–10 mm. long, with a maximum breadth of 1.5 mm. The colour remains much as described. The cerata are 20 or more on either side, not foliaceous but concave spoon-shaped laminae. The oral veil bears two longish processes, and the rhinophore sheaths from two to four. The rhinophores are brown or spotted with brown; they appear to bear a few very inconspicuous perforations below the club. The anterior margin of the foot presents various shapes and is probably alterable in life, but is not produced in conspicuous prolongations in any specimen.

The jaws are as in *L. genei*, with many rows of denticles or projections which have the appearance of a mosaic near the edges. The radula is in the confused state common in the genus. There are about 17 rows, and where the rows can be clearly counted the formula is 9.0.9. The teeth are irregularly denticulate on both sides, much as in *L. marmoratus*.

The liver appears to consist of three divisions and to enter the stomach by three ducts, one posterior and one on either side. The posterior liver is the largest; it encloses the hinder part of the stomach and extends some way backwards. The anterior livers run forward as far as the sides of the buccal mass. Though branches of the livers extend to the bases of the cerata, they do not send prolongations into them, or into the rhinophore sheaths. Both the cerata and sheaths contain blood-spaces but not hepatic diverticula. The genitalia appear to be mature. The verge is white, large and without any armature. The hermaphrodite gland is large and appears to contain ripe ova; it lies mainly under the posterior liver, but rises towards the dorsal surface at its sides. The mucus-gland is very large.

This species comes very near to *L. marmoratus* in size, colour, and anatomy, but differs in the following points:—(1) The shape is much more elongated and vermiform; (2) the cerata do not form a wavy curtain but a series of separate and equal projections, all on the same level, and though all are set on the prominent dorsal margin they are not connected by a membrane\*; (3) the corners of the foot are not developed into distinct prolongations. If these features were found in only one specimen their specific value would be doubtful, but as they occur uniformly in a large number they have some weight, particularly as it is a considerable assumption to suppose that *L. marmoratus* is found in the Red Sea.

\* It is of course difficult to be sure of this point in such small animals, for the membrane would be likely to shrivel up when preserved.

If this form is not a new species it is possible that it may be the young of *L. genei* or a variety of *L. marmoratus*, which itself may be the young of *L. genei*. If it is identical with any Mediterranean species, it would be interesting to know whether it is a natural denizen of the Red Sea or whether it has made its way through the Suez Canal. *Lomanotus* has not hitherto been recorded from the Indo-Pacific area.

*L. vermiformis* appears to be sexually mature, but it does not follow from this that it has attained its full size and final shape, for nudibranchs continue to grow after their sexual organs are functional.

#### CROSSLANDIA FUSCA, *Eliot*.

(*Eliot*: "On Nudibranchs from Zanzibar.—I.," Proc. Zool. Soc. 1902, pp. 64-68.)

Twelve specimens of various sizes and colours. The following notes, made by Mr. Crossland on the living animals, refer to the four largest, but he seems to imply that some of the smaller specimens were green.

"Four brown specimens from buoys at Nur el Shekh, Khor Dongonab, Red Sea, 10.12.07. Three found together on one buoy, one on the other. Length when fully extended is 38 mm.

"Colour varies as follows:—

"First specimen (like one taken here in May 1907) clear translucent fucoid brown with darker dots and a darker line edging dorsal crest and cerata. A few specks of opaque white laterally; two are conspicuous and bear conspicuous papillæ in the centre. A white line is present inside the dark edging of the crests.

"Second specimen ditto, but more white, in form of patches of opaque pigment put on so thinly as to be translucent.

"The third and fourth specimens are of a distinctly darker brown, with the addition not only of whitish but of purplish pigment, exactly the tint of the patches of encrusting nullipore and foraminifera generally present on weeds. This colour is remarkably strongly developed in the fourth individual. The bright blue circular spots noted at Zanzibar are here present also. In the third specimen they are easily visible to the naked eye, in the others only under a lens ( $\times 10$ ). In no. 2 they are rather dull and ill-defined.

"The series from green onwards is complete, showing all the range of protective colour devices characteristic of habitat among *Zostera*, *Fucus*, or darker weeds. It is to be noted that the colour scheme does actually correspond with the habitat; though there is little or no brown fucoid weed on these buoys, the growths present are of dark colours. Compare the exactly similar series of colours found in various species of Tectibranchs, where one species contains individuals of bright green, green with nullipore purple patches, fucoid brown and ditto with purple. In some of these cases the protective adaptation includes also the form of the animal (flattened): here

the form is adapted by being drawn out into crests and frills, the edge of which is cut into crinkles and points, like the leaves of the common fucus here.”

Mr. Crossland is no doubt right in regarding all twelve specimens as belonging to the same species, but in their preserved condition they exhibit considerable variety not only of colour but of form, due probably not to distortion but to different stages of growth.

A. Five of them are relatively large, being 18–22 mm. long and 10–15 mm. high.

- (1) One is pure white with yellow branchiæ, which are found only inside the wings and on the caudal crest. The wings are rounded.
- (2) As no. 1, but with yellowish-brown margins and spots. The margin of the wings is crinkled. Two specimens.
- (3) In two other specimens there is more green tint. There are chocolate markings and also a few brownish ocelli. In these specimens the branchiæ are found outside as well as inside the wings. The body is hard and stoutly built; the wings thickish and with strongly crinkled margins.

B. Seven smaller specimens, 6–14 mm. long and 4–8 mm. high. They are all whitish, but with a very variable number of bright brown spots. As a rule the branchiæ are found only inside the wings. In one specimen they also occur outside. In all the wings bear on their edges more or less developed digitate processes. In one specimen they are very distinct and symmetrical, five in number on each wing. In the others they are more irregular. There are also digitate processes on the mantle-edge, especially between the wings and rhinophores.

All the specimens have the following characters in common :—

- (a) There is a moderate but not large caudal crest, more marked and more jagged in the smaller specimens.
- (b) There is a row of papillæ (2–4 can be seen clearly in different specimens) on either side of the body, halfway down.
- (c) The wing on either side of the body never consists of two outgrowths or papillæ rising from separate bases with an interval between them as in *Scyllæa pelagica*, but always of a single common portion more or less notched or divided at the top. In the smaller specimens this common portion is about half the size of the whole expansion, and the outer part is more or less distinctly bifid and bears digitate processes. As the animal increases in size, the common portion grows at the expense of the processes, and the whole expansion ultimately assumes the form of an undivided fold with somewhat crinkled edges, much as in Mr Crossland’s figure of *Crosslandia viridis*, l. c.

The intestines are whitish, the liver greyish white. The spermatotheca is covered with fine brown dots.

The jaws are brownish near the edge, with three or four longitudinal stripes of darker brown. The rest of the surface is whitish. They are covered with a tessellated pattern which under a high power is seen to consist of small projecting scales with roughly semicircular and indented edges. The scales do not overlap but stand each at a little distance from the others.

The formula of the radula is about  $20 \times 25 . 1 . 25$ . In the previous description by Mr. Crossland and myself, we stated that the teeth in the middle part of the half rows are denticulate only on the external side, but though this is the appearance which they present *in situ* they are in reality all denticulate on both sides. It is extremely difficult to see the shape of the whole tooth from one point of view. They generally present the appearance of bearing 3 lateral denticles only, but in reality 5-9 were found to be present on all the teeth which I examined in detail. The hooks of the teeth are fairly strong and erect.

The œsophagus passes into a long unarmed stomach with thin walls, and that into a second stomach armed with a circle of 16 plates, yellowish, triangular and alternating in size. The whole alimentary canal is a tube of unusually uniform breadth, not presenting marked pouches or constrictions.

The two divisions of the liver adhere to the outer wall of the stomach and no long connecting ducts are visible, nor could I find any hepatic diverticula extending into the cerata. The liver can be removed without difficulty from the body-cavity and does not adhere to its walls.

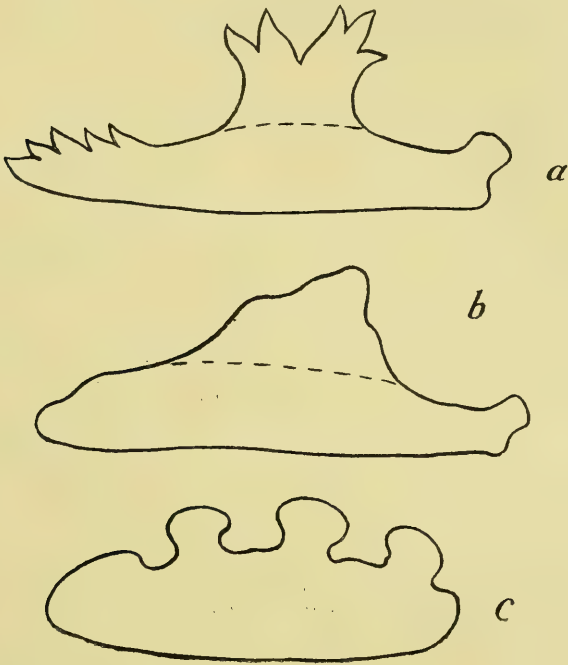
The hermaphrodite gland forms three large white spherical masses.

Mr. Crossland also describes and gives a rough figure of the spawn. It is deposited in a single coil, which he says resembles a string of beads, each bead containing from twenty to fifty eggs. The colour of the coil is light yellow-brown, and there are four gelatinous envelopes—(1) the attachment jelly; (2) and (3) coverings of the egg-strings; (4) a covering round each separate egg. It would appear from his figure that the egg-strings are twisted within the string of jelly, independently of the coiled shape of this latter.

These specimens seem referable to the forms previously described as *Crosslandia viridis* and *fusca*, the two being, as was surmised, varieties and not separate species. It is preferable to keep *fusca* as the specific name rather than *viridis*, firstly, because the larger of the specimens belong to that variety, and secondly, because in the event of the genus *Crosslandia* being united with *Scyllaea* the name *Sc. viridis* is preoccupied by one of Alder and Hancock's species.

Provisionally I keep the genera distinct though now thinking the difference between them of doubtful generic value, since the young *Crosslandia* has

much more the appearance of *Scyllæa* than the adult animal. The chief differences are:—(1) In *Crosslandia* the liver is only slightly, if at all, ramified. In the present specimen no branches at all were found, but it is probable that individuals (as in *Dendronotus* and *Bornella*) show considerable variation in this respect. In *Scyllæa* the liver is considerably ramified, though it does not penetrate the rhinophores and papillæ to the same extent in all species.



(2) In *Scyllæa* there are on either side two dorsal processes quite distinct from one another. In *Crosslandia* the two are joined. The dorsal outgrowth thus formed is deeply bilobed in the young animals; in the adults the bilobation more or less completely disappears and a single wing-like expansion is the result. I cannot find in any description or figure\* of the species of *Scyllæa* a record of such a formation, nor have I come across it in examining a great number of specimens labelled *Scyllæa pelagica* and coming from both the Atlantic and Indo-Pacific Oceans. It must therefore, I think, be regarded as a distinct character of at least specific importance. The

\* Possibly the figure of *Scyllæa Hookeri* (no. 203 in Mrs. Gray's 'Figures of Molluscous Animals') may be the young of this form. But nothing seems to be known of the name except this not very distinct figure.



accompanying series of figures shows the outlines copied from actual specimens of (a) a young *Crosslandia*; (b) an adult *Crosslandia*; (c) a *Scyllaea pelagica* from the Indian Ocean.

It is interesting to observe that the caudal crest and the digitations of the wings disappear as the animals grow older. Something similar seems to occur in *Lemanotus Evisigi* as described by Trinchese. He states that the young animals have almost the appearance of *Æolids* with separate dorsal papillæ, but as they grow up these become united at the base, so that in the adult the back is bordered by a membranous expansion bearing points.

#### MELIBE BUCEPHALA, *Bergh*.

(Bergh: "Danish Expedition to Siam," Gasteropoda Opisthobranchiata, 1902, p. 205, ff.)

Two specimens. The notes say they were found washed up on the sand between Suez and Port Tewfik. They were transparent and colourless, except for a light tinge of brown and a plentiful sprinkling of opaque white dots. They also bore numerous raised spots, which were white or brown on the body but often colourless on the cerata.

The larger specimen is about 90 mm. long including the hood. The body bears no woolly or filamentous processes, but is covered with soft tubercles which are often compound. On the back between the cerata these tubercles become elongated and bear five or more short branches, but they are not foliaceous and can hardly be termed branchiæ. The cerata have mostly become detached, but there were apparently five pairs and an unpaired one on the tail (absent in the second specimen). Their shape is very various, and shows that in dealing with preserved specimens this character must be used with caution as a specific distinction. It would seem that the cerata in their natural condition have a fairly long stalk which is constricted at the base, but in the upper part becomes gradually wider and thinner until it terminates in a membranous expansion which is notched in the middle (more distinctly in one specimen than in the other). The whole surface of the cerata is covered with knobs which become smaller towards the top, where they are replaced (especially on the inside of the cerata) by short thin papillæ.

The hood is large and its outer surface much like the rest of the body. The margin, which bears three or four rows of simple cirrhi 2-3 mm. long, is not even but deeply incised below the mouth and in the corresponding point on the other side. Both specimens show this peculiarity, and the line of the cirrhi is continued in the notches, though they are less numerous there. The rhinophore sheaths are small with a membranous expansion behind, tuberculate and with crenulate margins. The rhinophores themselves are yellow with only a few perfoliations.

At the bottom of the hood is a round fleshy lip, covered with minute papillæ which are tipped with opaque white. Below it are two small

yellowish jaws, about 4 mm. long. They are faintly striated and under a high power are seen to bear on the edge low, wavy prominences which can hardly be called denticles. From the mouth a tube with laminated walls leads into a small yellow stomach, which is armed with 19 or 20 plates and prolonged posteriorly into a dark-coloured tube. The plates are rather bright yellow in colour, hog-backed in shape, and alternately large and small. The larger are about 3·5 long and ·5 mm. high; the smaller half the size. The liver is a flocculent and rather diffuse collection of brown tubes, spread over and between the globules of the hermaphrodite gland and lying behind the stomach. Two accessory portions of the liver open into the stomach right and left. The branches of the liver which go to the cerata are more compact than the main mass. Up to the bases of the cerata they are of a considerable size (about 3·5 mm. broad), but after entering the appendages they contract and become much narrower. They extend about two-thirds of the way up the cerata and divide into two or three branches.

The hermaphrodite gland consists of a number of spherical globules which occupy a considerable portion of the body-cavity. There is a large, soft, round prostate, from which issues a strong and muscular vas deferens. The penis is large and distinctly hooked in both specimens. The fan-shaped organ described by Bergh in some species was not found, but near the end of the female branch is a large sac-like organ which is exerted in one specimen so that the orifice lies at the bottom of it.

This appears to be the *M. bucephala* of Bergh. The shape of the hood is the same in both specimens, and does not look as if it were due to distortion or mutilation.

Although the generic characters of *Melibe* are remarkable and easily recognizable, the specific distinctions within the genus are very indefinite and few of the species can be regarded as certain. It is probable that they all have jaws, though the contrary has been asserted and I was unable to find any in a specimen of *M. pilosa* which I examined in Japan both while it was alive and directly after death. The jaws usually lie immediately below the lips, and the difficulty of finding them is probably due to the fact that in death the buccal parts may be abnormally protruded or retracted so that the jaws become situated in an unexpected place.

#### *ÆOLIDIELLA ORIENTALIS*, Bergh.

(Bergh: Mal. Untersuch. in Semper's Reisen, Heft xvii. p. 875; *id.*, Beiträge zur Kenntniss der Aelidiaden, IX., in Verhand. der k.-k. zool.-botan. Gesellschaft in Wien, 1888, p. 673.)

Five specimens said to have been found "in the washings of coral &c. from a buoy in Suez Bay." The notes on the living animals are as follows:—  
"Small, white with orange-red markings. Short and stumpy in form.

Rhinophores and cerata short and simple. Rhinophores not perfoliate ; eyes just behind them, conspicuous. Foot broad, especially in front, but no pedal tentacles. Oral tentacles fairly long.

“ Body translucent, but ends of rhinophores whitish and the greater part of their length orange-red. A V-shaped (inverted) mark behind them of the same colour, and two broad marks running forward from the base of the rhinophores. There are faint sprinklings of the same pigment over cerata and body. There are on the back whitish marks as shown in the sketch, and a very faint brown tinge (due to the liver) in the bases of the cerata.”

A rough sketch shows a  $\Lambda$  between the eyes, and behind them a pattern having somewhat the shape of a Greek vase without handles extending down the centre of the back.

The largest of the preserved specimens is 9 mm. long and 2.5 mm. broad. The others are rather smaller. The cerata are not arranged in any visible groups, but are set three or four deep all along the sides of the body, as far as the tip of the tail. On either side there are about 30 cerata of moderate size, and outside, in the outermost line, ten or twelve minute ones. The cerata are fusiform in shape but occasionally dilated at the tips.

The jaws are yellow ; the edge is undulated but no denticles were seen. The radula consists of only twelve teeth. The shape of the smaller teeth is much as in Bergh's plates (*l. c.*), but in the larger ones the central part is much more developed and more conspicuous, so that the whole looks like a shield with two pectinate wings. The median denticle is fairly strong with a minute denticle on either side. The wings bear from 14 to 20 denticles. No armature was found on the genitalia.

In spite of some slight differences of coloration this seems to be Bergh's *Æolidiella orientalis*, which is distinguished from the other species by having the anterior margin of the foot rounded and not produced into pedal tentacles. In Bergh's specimen the lateral denticles of the teeth were more numerous and the radula longer, but the animal was also considerably larger (23 mm., whereas these specimens are only 9 mm.). As the radula grows the teeth become more numerous, and it is clear from the present specimens that the later teeth grow broader and bear more denticles.

#### ELYSIA GRANDIFOLIA, *Kelaart*.

(Kelaart : *Ann. & Mag. Nat. Hist.* 1859 (3), iii. p. 493 ; Eliot : “ *Nudib. of S. India & Ceylon*,” *Proc. Zool. Soc.* 1906, p. 689.)

The notes on the living animal are as follows :—“ Under stones, reef-edge N.E. boundary of Shabul Shubuk. Rather a dull green, mottled with darker spots. Edges of lateral expansions with a thin clear black line, within which' is a rather broader yellow line. Rhinophores edged in the same way but neck is green all over. *The lateral expansions are much*

*crinkled when crawling and are carried upright.* Large specimen 3 cm. long, small 1.7."

Three specimens are preserved. They are whitish, with a plain grey border to the wings and rhinophores, and a few grey spots scattered over the upper and under surface, and in one specimen especially numerous on the pericardium. In some specimens there are also traces of yellow coloration.

The largest specimen, which is leaf-like and somewhat crumpled, is about 27 mm. long and 22 mm. broad. Could it be spread out flat, the dimensions would be rather greater. The anterior genital mass is blackish and is visible through the skin, as are also the follicles of the hermaphrodite gland which extend almost to the edges of the wings and give the dorsal surface a mottled appearance. The veins on the back are very prominent and distinct. The pericardium is considerably prolonged in two specimens, as in Kelaart's figure. In the third this prolongation is less noticeable and the organ is constricted in the middle so that its shape is that of an hour-glass.

The radula in the specimen dissected consists of 5 teeth in the ascending portion, 18 in the descending, and about 15 in the heap. The teeth are of the usual shape. The tip is not very pointed and the anterior part of the lower edge is minutely serrulated. This serrulation is visible only under the highest powers and then with difficulty, but still it can be detected on all the teeth, even the small ones.

It is doubtful if many of the described species of *Elysia* will ultimately prove valid. Kelaart's names (*grandifolia*, *punctata*, and *cærulea*) have priority. The last of these (= *E. lineolata*, Bergh) is clearly distinguished by its brilliant coloration. In the others the coloration (especially the borders and spots) is very variable, and there are few other definite specific characters. The teeth of *E. grandifolia* are serrulate and those of other species smooth, but since the serrulation is only visible under the highest powers its absence cannot be assumed unless a very thorough search has been made.

#### HEXABRANCHUS.

The animals of this genus are very variable in shape and colour, and few of the described species can be regarded as certain and well characterized. The species or variety noticed below is undoubtedly the *H. prateatus* of Ehrenberg (1831), but there can be equally little doubt that it is also the *Doris sanguinea* of Rüppell & Leuckart (1828), and this specific name must therefore have priority.

The *H. punctatus* recently described by Bergh ('Siboga' Expedition, 1905, p. 92) is, I think, the same as the animal described by me under the name of *H. adamsii* (?) in the Proceedings of the Malacological Society, 1905, p. 235. The species is probably the animal figured by Adams, though as we have

practically no information except the figure, the identification must be somewhat doubtful. Whatever the animal is called it appears to be a distinct species, as Bergh says, and more definitely characterized than most.

*HEXARRANCHUS SANGUINEUS* (Rüppell & Leuckart).

(*Doris sanguinea*, Rüppell & Leuckart in Neue Wirbellose Thiere des Rothen Meeres, 1828, p. 28 = *Hexabranchnus prætextus*, Ehrenberg: Symbolæ Physicæ, 1831. Cf. Hägg: "Two new Opisthobranchs from the Red Sea," in Results of Swedish Zool. Exped. to Egypt and White Nile, 1901, p. 5.)

The notes on the living animal say: "Hexabranchnus; seen on the reef south side of Tella Tella Saghir at a depth of one fathom and obtained by diver. Colour as in the East African variety in which there is no yellow. The whole body is pure crimson except the mantle-edge which has the usual streak of white."

This is the *Hexabranchnus prætextus* of Ehrenberg, the type of which was captured at Tor in the Red Sea. The species has been described under many other names, and in particular *H. anaitens*, Bergh, *H. Petersii*, Bergh, *H. suzensis*, Abraham, and *H. plicatus*, Hägg, are probably referable to it. Hägg in defining the characters of his *H. plicatus*, forgets that these animals can alter their shape and proportions even in life, and the fact that one alcoholic specimen is circular and another elliptical is not necessarily of any specific importance.

*H. sanguineus* seems to be characteristic of the Red Sea but less common elsewhere. On the coast of East Africa I found it much more rarely than the mottled varieties.

*NEMBROTHA LIMACIFORMIS*, sp. nov.

Two specimens described by Mr. Crossland separately, but apparently referable to the same species. The notes on the living animals are as follows:—

(1) "Polycerid, on a piece of coral obtained by a diver from 1 fathom on a reef in the S.E. part of Shab ul Shubuk. Strikingly long and narrow, measuring 20 mm. × 4 mm. when crawling. The head is rounded and about one millimetre wider. The foot is a mere groove. The body tapers to the sharply pointed tail, but is rounded in cross-section and has no processes whatever. Gills short and thick, irregular in arrangement, so that it is not easy to say whether there are 3 or 4. They are very contractile but there is no gill-pocket. Rhinophores perfoliate, very long and carried vertically; they have no proper pockets. Colour blood-red, with sparsely scattered small yellow dots and a few yellow blotches. Gills bright light yellow

tipped with violet, and the rhinophores which are blood-red like the body are also violet-tipped."

(2) No locality is given. "Polycerid. Limaciform with pointed tail. Rhinophore cups with low raised rims. Colour red-brown with bright light yellow opaque dots and three marks of the same: one pear-shaped in the middle part of the front of the mantle, and the others, more elongated, behind the rhinophores. Rhinophores brown like the body but with a large clear violet spot at the tip of each. Gills light yellow, tipped with violet; three in number; irregularly bipinnate."

The preserved specimens are much distorted and contracted into an almost spherical shape. No external appendages are visible except the gills, which are as described by Mr. Crossland. The rhinophores are completely retracted, in spite of Mr. Crossland's remark that in the living animal there were "no proper pockets."

The integuments contain spicules, granulate and rather irregular in shape, slightly swollen at both ends but not branched.

In the central nervous system three pairs of ganglia are visible, the division between the cerebral and pleural portions being distinctly marked. No trace of a labial armature was found. The radula consists of ten rows in one specimen and eleven in the other with a formula of 7.1.1.1.7. Though the rhachis is almost entirely hidden by the large laterals which close over it, it is wide and bears in the middle a row of squarish plates, somewhat thin and indistinct. Their anterior margin is reflexed and bifid or indistinctly jagged. In some cases the right side is slightly higher than the left. At the side of these teeth are slightly raised areas of irregular shape which are perhaps merely folds of skin, but might be regarded as indistinct accessory teeth. The laterals are large, yellowish, and of the type usual in the genus. They have a strong and rather rectangular terminal hook and also a strong wing or spur, and project into the rhachis across the median teeth. Beyond them are seven marginal teeth, low and colourless. The first retains something of the hamate shape; the rest are mere plates. The seventh is sometimes absent and in a few rows there are only 5. The genitalia were too hardened for examination.

The combination of shape, colour, and denticulation found in these specimens does not harmonize with any of the described species of *Nembrotha*. It is possible that the animal is a lighter coloured variety of *N. rubro-ocellata*, Bergh ('Siboga'-Expeditie, p. 201), which is only imperfectly known, the radula having been lost. It seems best to create a new species characterized by (1) its elongated, limaciform shape; (2) its coloration, red, yellow, and violet; (3) its dentition. *Angasiella edwardsii*, Crosse (Journ. de Conchyl. 1864, 3<sup>me</sup> série, tom. iv. no. i) is possibly a *Nembrotha* of similar shape, but is said to be covered with small spines.

*TREVELYANA STRIATA*, sp. nov.

The notes on the living animal are as follows :—

“From shallow water: bottom mud and weed. 3.7 cm. long, white with thick definite bands of bright dark yellow. One forms a border to the mantle and foot, others, which are broken, extend down the back and sides of the body. All are raised more or less. Gills as in *Trevelyana*, pinnæ more or less parallel with the rhachis. In this species the gills are arranged in a transverse row across the body and project on either side. The middle three in front of the anus are reduced: the whole are placed at about the middle of the length of the body. The rhinophores and rhachis of gills are also yellow. Tail short and blunt; the median yellow line upon it is much raised into a crest. The animal is very soft and contractile.”

As preserved it is much contracted and the external features are distorted; but as Mr. Crossland labelled it *Trevelyana* it probably had the usual shape of that genus when alive. The ridges are still plain and the following can be distinguished:—(a) a medio-dorsal ridge, well-developed behind the branchiæ but imperfect in front of them; (b) a ridge on either side of this, well-developed before the branchiæ but imperfect behind them; (c) a ridge running completely round the body and forming, as far as can be judged, both a mantle-border and a frontal veil; (d) two ridges on the sides of the body. All these ridges are very distinct and about one millimetre high.

The anterior part of the body is much retracted, and the rhinophore openings cannot be seen. The branchiæ form a straight transverse line in a cleft. In the middle are three small ones in front of the others. Those at the sides are larger and pectinate, but it is difficult to count the number as smaller plumes are mixed with the large ones, and might be variously considered as separate or annexes. There are about 6 large plumes on either side of the centre.

The blood-gland is thick and purplish grey. The central nervous system consists of three very distinct pairs of ganglia, the cerebral and pleural ganglia being clearly distinguished. The salivary glands consist of two short, thick, white bands. No trace of an armature was found on the labial cuticle. The radula is fragile and torn into two pieces. The formula is apparently about  $14 \times 18.0.18$ ; but perhaps there are as many as 22 teeth in some rows. The teeth are awl-shaped and all much the same; but those which appear to be the innermost (though their position is not quite certain) are taller and straighter than the rest and have smaller bases.

The hermaphrodite gland is represented by a single irregularly shaped mass, which is deeply furrowed but not divided into separate globules. The spermatheca is small and round: the spermatocyst of about the same size and pear-shaped. The penis and the lower portion of the small vas deferens are armed with minute transparent spines. A reticulate gland, resembling the

prostate of *Euplocamus* but smaller, envelops the vas deferens, the spermato cyst, and the spermatheca.

This animal does not coincide with any of the recorded species of *Trevelliana*. Externally it is characterized by the very distinct and prominent ridges; in the internal genitalia, the hermaphrodite gland and the prostate offer peculiarities.

#### OHOLA PACIFICA, *Bergh*.

(Bergh: 'Challenger' Expedition, Zool. x. Nudibranchiata, p. 52, 1884.)

The notes on the living animal say: "Polycerid from Mersa Makdah, 7 fathoms. Of an extremely soft gelatinous consistency and bright orange colour except for certain marks of black and dark blue, *e.g.*, the edges of the rhinophore cups are black, the rhinophores themselves blue: the gills have each a black line on the back of the rhachis; there are marks on the processes behind the gills, on the tip of the tail and at the angles of the velum."

The preserved specimen is 17 mm. long, 6 mm. broad, and 7.5 mm. high without counting the gills. The free part of the tail is 4 mm. long. The animal is stoutly built, and the colour, which has now become grey and black, is distributed as described above. The head parts are contracted and distorted, so that the structure of the rhinophore sheaths is not very plain. It would appear that the openings are partly surrounded by a fold of skin, and protected on the outside by a large process about 2 mm. long. The rhinophores are small, dark, deeply retracted, and bear a few perfoliations. The branchiæ are four or five. In front of the anal papilla is a very large and strong plume, with an accessory plume on the left. The lateral plumes on either hand are also strong and distinct but not so tall. Behind the anal papilla are some small low branchial tufts which are not combined into a plume. Behind the branchiæ are two large processes 4 mm. long, and on the tail what looks like the remains of a jagged crest.

The central nervous system, as seen from above, shows four very distinct divisions arranged in a line on the œsophagus. The pedal ganglia are roundish: the cerebral and pleural ganglia are fused into an elliptical or pear-shaped mass, but the two parts can be distinguished.

The jaws are yellow with processes attached as in *Polycera quadrilineata*. The radula consists of 12 well-formed rows and two more in a shadowy and undeveloped condition. The formula of the rows is 2+2.0.2+2. There is no central tooth, and the rhachis is broad. The two innermost teeth are hamate much as in *Polycera*, and dark brown. Then come two plate-like teeth, one rather large, the other very small, and both colourless.

The lower part of the vas deferens is thickly armed with spines bent at various angles.



This animal appears to be Bergh's *O. pacifica*, known hitherto only by one specimen from the Arafura Sea. It is easily recognizable by its huge dorsal papillæ which give it a strange appearance, but otherwise it differs only slightly from *Polycera*; it has no processes on the frontal veil, and the radula is narrower.

PLOCAMOPHERUS, *F. S. Leuckart.*

(See for the genus Eliot: "Nudibranchiata from Cape Verde Islands" in Proc. Malac. Soc. 1906, p. 149, and authorities there quoted.)

The type of this remarkable genus is *Pl. ocellatus* described below, of which nothing has been known since specimens coming from the same locality, the Red Sea, were noticed and figured by Rüppell & Leuckart in 1828. It agrees in all essential generic characters with the species which have been subsequently investigated.

PLOCAMOPHERUS OCELLATUS, *Rüppell & Leuckart.*

(Rüppell & Leuckart: 'Neue Wirbellose Thiere des Rothen Meeres,' 1828, p. 17.)

Mr. Crossland's notes on the living animal are as follows:—

"From 5 fathoms Suez Bay, bottom mud.

"In shape recalling the vermilion species from St. Vincent, Cape Verde \*, *e.g.*, gills in middle of back and the long tapering tail with a crest. This tail-crest becomes a great fleshy hump proximally. The mantle round its front edge develops a frill of branched processes, and below this are two light-coloured slightly lobed semicircular ridges. The foot is grooved and notched. The general colour is chocolate-brown, but gills and rhinophores, tips of lateral processes, &c., are very dark. Body lighter below and spotted with yellow, very clear (but not light) round spots. These become orange low down on the sides of the body. There are long whitish tentacles laterally with clubbed chocolate ends and small branched side processes.

"Much contracted on killing.

"In Suakim Harbour; several specimens found on the boxes in which live Pearl Oysters were kept."

Five specimens are preserved, one of which is very much larger than the others. It is 23 mm. long, 11 mm. broad across the branchiæ, and 13 mm. high to the tip of the branchiæ. The colour is a rich deep brown with some white mottlings. The ocelli are of a lighter shade, but with dark rims and one or several (2-5) brown dots in the centre. As in the specimens of *Ploc. maderæ* from Cape Verde, the ramose nature of the processes is much clearer in the smaller than in the larger specimens. In the largest specimen of all, hardly any trace of branching remains. About ten processes can be distinguished on the veil over the mouth, but they evidently have a strong

\* *i. e.*, *Plocamopherus maderæ*.

tendency to contract and disappear when preserved, and the real number may have been greater. The rhizophore sheaths, the branchiæ, and three pairs of dorsal processes are much as in *Ploc. maderæ*, and there are only indistinct traces of other processes lower down on the sides of the body. The branchiæ form a rather wide bow in front of the anal papilla. The two lateral plumes on either side are connected at the base, with the common result that the number can be counted as either five or three.

The integuments are thin. The buccal mass is fairly large. A rather long and broad tube, laminated internally, runs from it to the liver. The liver-cavity appears to act as the stomach, and no external dilatation was found. The intestine is thin. The liver is of a deep chocolate-brown with a whitish layer of the hermaphrodite gland outside.

The labial armature is a mass of closely packed rods, of somewhat varying shape, which form two greyish-yellow hatchet-shaped plates. The radula consists of 21 rows, with indications that three or four more have been worn off in front. The first 14 rows are of a deep reddish brown, the next four are orange, the next two bright light yellow, and the last white. The formula is 9 (or 10) + 3 . 0 . 3 + 9 (or 10). The rhachis is very wide and folded down the middle so as to form a deep valley, and divided into areas by transverse lines corresponding to the rows of teeth. The three innermost teeth are hamate. The first has a pointed base which projects into the rhachis and looks like another tooth. This first tooth is not much smaller than the others, but the second and third have larger and more spoon-shaped hooks. The nine or ten outer teeth are not hamate: the outer ones are mere plates, and the two or three nearest to the hamate teeth show irregular prominences arising from a plate.

The central nervous system is yellow and markedly granulate. The cerebral and pleural ganglia are distinctly divided.

The lower part of the vas deferens and the glans penis bear very numerous, rather elongate, irregularly arranged spines, and there are some larger scales or prominences in the sheath of the penis. The prostate is whitish and very large. It is of a ramified or reticulate appearance and surrounds the spermatheca. The large spermatheca and the spermatocyst are both elongate. The end of the female branch is very thin.

Since the above was written Mr. Crossland has sent me two more specimens of this species from Dongonab Harbour, and says that the animals were in life extremely beautiful. His notes are as follows:—"Largest specimen, when fully extended, 85 mm. long including the extremely acuminate tail, which is about 15 mm. Another specimen 54 mm. long, 8 mm. broad. One specimen has a much darker tint than the other, like half-dry blood. The yellow spots are broad rings, not always round, with dark brown centres and thin brown rings bordering the yellow outside. The lighter specimen has many small flecks of yellow as well as the larger rings, but the dark

specimen has few of the former and more of the latter. Colour of the lighter specimen not uniform, dark and light brown blotches and a good deal of dirty white pigment on the body. In this specimen the dorso-lateral processes are hardly branched at all, and in both only the pair just behind the gills have clubbed ends, which are chocolate in one specimen and light brown in the other. Other details as in former description, except hump on tail which is not so much cut off from the tail-crest."

The length and narrowness of the living animals, according to the above measurements, are remarkable. They can doubtless alter their shape and become less elongate. As preserved, the largest is only about 25 mm. long and continued into an almost globular mass. Neither the frontal veil nor the dorsal processes are conspicuous. The processes appear simple, but when expanded in water each is seen to bear 2-4 small secondary branches, which in their turn bear knobs. The colour of both specimens is purplish with yellowish ocelli. The outline of these ocelli, as well as of their centres, is often irregular and not even approximately circular. In other respects the specimens conform to the previous description.

Mr. Crossland also notes that this species, like many other nudibranchs, suddenly appeared for a short time in great abundance and as suddenly disappeared, after depositing pink spawn, which is not of the same colour as the parent animal and is attached to Polyzoa. The colour of *Plocamopherus ocellatus* varies and appears to depend on its food, which was ascertained to be in some cases a "dark purple-brown branching Polyzoan which is abundant on the underside of our boats." When specimens were kept for 24 hours without food, they became very pale in tint and the colour seemed to pass out of the body in the excrement.

The following further notes on the phosphorescence of the animals are interesting:—

"March 5, 1908.

"The specimens kept in a pie-dish, with frequent changes of water, have been very sluggish all day, generally half-contracted and loosely adherent to the dish. They are not used to the light at any time. At night found them actively crawling loosely extended, and even swimming by bending the body head to tail on either side.

"When undisturbed they often emit a fairly bright light which glows steadily for about 5 seconds, goes out, and reappears after an interval of 5-10 seconds. This is emitted from the tip of one of the pair of dorsal processes situated halfway between the head and the gills. (The ends of this pair are rarely club-shaped.) Occasional bright flashes may be given off by the gills.

"This performance may be in abeyance for some time, but all the six specimens regularly lit up, now one, now another, or all together.

"On touching the surface of the water or flicking it with one's finger, a

brilliant blue-green flash of light comes from the gills of each specimen. The gill is shown up plainly, and shown to be half-contracted. The light comes from the finer branches, and the larger ones show dark against the light. On flicking the water the light ceases to be shown after the second or third time. If now any part of the body is touched a brilliant series of rapid flashes lasting up to five seconds appears from the gills, the effect being like miniature tropical summer lightning. This also ceases to be shown after the third or fourth irritation. The animal may take to swimming, and then clouds of luminous mucus fill the water with light.

“The strong irritation of a fresh specimen results not only in the main display from the gills, but also a milder yet brilliant and steady light is emitted from the edges of the tail, dorsal crest, and various points and processes of the body.”

*GONIODORIS CASTANEA*, Alder & Hancock.

(Alder & Hancock: Monograph. Fam. I, pl. 19, 1846. Bergh: “Die Gattung *Goniodoris*,” Malac. Blätter, Neue Folge 2, 1880, p. 126. For the genus see Eliot: Journ. of Conch. vol. ii. Oct. 1905, p. 243.)

Sent to Mr. Crossland by Mr. J. G. Logan of Suez. No notes except the label “Nudibranch among compound ascidians.” Five specimens, of which the largest is 10 mm. long, 5 mm. broad, and 4·3 mm. high. The others are much smaller. All are yellowish brown with markings of darker brown, and in all of them portions of the viscera show conspicuously through the semi-transparent skin as of a deep blue-black. The foot is broad, wider than the body, and the tail bears a well-developed ridge. At the side of the head are large lobes as usual in the genus. The dorsal margin is raised, forming a distinct rim all round the back. Down the middle of the back, from the rhinophores to the branchiæ, runs a ridge. In some but not all of the specimens there are other inconspicuous projections on the back which may be artificial puckers or accessory ridges. The rhinophores are set far forward: they are rather large, non-retractile, and bear about twelve perfoliations. The branchiæ also are non-retractile, seven in number, stout and tripinnate. In some specimens they are tipped with dark pigment.

On opening the body the liver is found to be of a deep dark green colour, covered in parts but not everywhere with the bright light yellow follicles of the hermaphrodite gland, which contrast with it vividly.

In the central nervous system the cerebral and pleural ganglia are closely united, and the pedal separate, so that there seem to be only two pairs of ganglia in all above the œsophagus. The eyes are large and black, set on short stalks. The commissures are short.

No labial armature in the ordinary sense was found, but on the lips are a number of dark ridges and prominences, which perhaps are the structures

described by Bergh, *l. c.* ("Lippenplatte . . . nur aus höckerartigen Verdickungen der Cuticula bestehend").

The formula of the radula is about  $24 \times 1 + 1.0.1 + 1$ , and the teeth are as usual in *G. castanea*. The large tooth has a broad base and a kink in the back. It bears no denticles. The small tooth is hard to see. It is little more than a plate with a mark which may be a jag or a vestigial hook. The *ingluvies buccalis* is small with a very short thick stalk.

The *vas deferens* is armed with spines set on flat plate-like bases.

This form does not appear to be identifiable with any of the known tropical species of *Goniodoris*. It cannot be *G. modesta*, which has a long thin tail, or *G. citrina*, which has a lobed mantle margin and denticulate teeth. *G. aspersa*, which is more like it, is said to have rudimentary jaws, like *Acanthodoris pilosa*, and also a smooth back and a reflexed mantle-margin. On the other hand, the present specimens agree in most points with the descriptions of *G. castanea*, though the labial armature is perhaps even less definite than as described by Bergh. The distribution of this species is very remarkable. It is recorded from the N. Atlantic, the Mediterranean, and New Zealand (Bergh, in Semper's *Reisen*, vi. ii. p. 89), where it was found on the keel of a ship which had been sixteen months in Otago Harbour. It may be wondered whether its presence at Suez is due to natural distribution or to artificial importation from the Mediterranean.

#### CHROMODORIS DIARDII (*Kelaart*).

= *Chr. semperi*, Bergh.

(Eliot: "Nudibranchs of S. India & Ceylon," *Proc. Zool. Soc.* 1906, p. 643.)

Nine specimens found on sponges dredged at Port Tewfik and Suez. The following are Mr. Crossland's notes on one of the Port Tewfik specimens:—"Elongate, high body with a narrow mantle, which however is kept down in crawling. Length 1.6 cm., breadth 0.35 cm. Gills 11, small, the anterior ones largest, set in a circle open behind. Pinnules very small; a vermilion band on outer and inner edges of gills: the rest white. Both the rhinophores and gills are retracted with difficulty and soon reappear: the rhinophores are taller than the gills. Colour creamy white with bluish-grey mottlings. Both colours have deeper tints on raised blotches, the former becoming rich cream and quite yellow towards the mantle-edge, the latter like blue-black ink with pure vivid dark blue at the margins in some cases. In front of the rhinophores are three black and two cream-coloured blotches. The foot is very light blue with blue and blue-black spots. There is little cream-colour except near the edges. The foot projects behind the mantle when the animal is crawling."

The preserved specimens are of a greyish colour with markings (which take the form of dots as well as of larger blotches) of dark blue and

yellowish white. The blue markings show no tendency to arrange themselves in lines, but in one specimen the yellowish spots are confluent and form a medio-dorsal stripe from the rhinophores to the branchiæ.

I have endeavoured to show (*l. c.*) that Bergh's *Chr. semperi* ought to bear the earlier name given by Kelaart, and also that *Chr. nigrostriata*, Eliot, and *Chr. tenuilinearis*, Farran, are merely varieties of the same species. If *Chr. diardii* is recognized as the specific name, then var. *semperi* will be the variety in which the coloration is composed wholly or mainly of spots, blue and yellow; var. *tenuilinearis* will be the pale variety with greenish lines; var. *nigrostriata* the violet-coloured variety with yellow spots and lines of black or deep blue, while the yellow variety with black stripes will be var. *flava*. (See Eliot, in Proc. Zool. Soc. 1904, p. 395, and Journ. of Conchology, 1905, p. 246.)

In a letter just received, Mr. Crossland reports that "a blue *Chromodoris* of a species common in Zanzibar," by which he probably means the present animal, is distasteful to fish. He says: "I threw in the *Chromodoris* to see whether its colour would be any protection to it. About half a dozen fish dashed up at once, but only touched it with their mouths and turned away directly. Their getting so close to it leaves me in doubt whether they were repelled by its smell or colour. I think smell is negatived because (1) none is perceptible to human senses as in *Ceratosoma*, &c.; (2) the same fish devour, *e. g.*, the guts of *Balistes* which had been in formalin over night, and even the flesh of specimens of *Margaritifera vulgaris* which had been in formalin for three weeks."

#### CHROMODORIS QUADRICOLOR (*Rüppell & Leuckart*).

(See Bergh: Mal. Unters. in Semper's Reisen, vi. ii. 1905, p. 68, and 'Siboga'-Expeditie, 1905, p. 143. Bergh originally described the species as *Chr. Elizabethina*, but subsequently identified it with Rüppell & Leuckart's *Doris quadricolor*.)

Three specimens from Mersa ar-rakiya, where they were found on a piece of leafy sponge in half a fathom of water, and one from Engineer Island. The notes on the first three specimens are as follows:—"In all three specimens there is much more black than white, and the white stripes on the dorsum and the sides are of a bluish tint. The stripe round the edge inside the yellow is pure white. In two specimens the yellow is rich and nearly pure, but in the third the border of the mantle is dirty white with a yellowish tinge and the white stripes on the back are broader\*. The white stripes bifurcate behind the rhinophores and they join behind the gills. There are two white stripes on the sides of the body, as well as those under the edge of the mantle and at the edge of the foot. All the specimens are

\* As preserved, the back might almost be described as a white background bearing black bands.

much the same size : 7.3 cm. long, 2 cm. broad, and 2 cm. high. In one specimen the gills are quite regular, long, unbranched plumes with minute white pinnæ, 12 in number. In another specimen, most of the gills bear small branches near their tips. In the grey specimen they are very irregular and there are numerous small ones at the turned-in ends of the line." (I understand this to mean that the branchiæ are set in an incomplete circle and that those at the point nearest the gap turn inwards. At this point there are numerous small plumes.)

The specimen from Engineer Island, which is preserved in formol, has the branchiæ and rhinophores of a brilliant orange, and a line of the same colour round the mantle and foot. The other specimens have become black and white. They are all remarkably large.

*CHROMODORIS MACULOSA, Pease.*

(Pease : Amer. Journ. of Conchology, 1872, vol. vii. p. 16, pl. 7. fig. 1\*.)

The notes on the living animal are as follows :—“ Dorid from coral nullipore reef at the Beacon, Khor Dongola. Elongated and rather flat : mantle broad, especially over head. Foot ends in sharp point projecting behind mantle. Rhinophores long and erect. Gills small and thick, seven in number, simply pinnate, the two hindmost smaller. Foot grooved in front, and the groove has thickened edges. Tentacles finger-like.

“ Colour in the centre a translucent greyish pink. Round this a broad undefined band of opaque white, and outside, bordering the mantle, a broad transparent orange-yellow line interrupted by opaque white spots along the edge. The gills have yellow tips, but the rhinophores are colourless at the base and translucent white in the perfoliate parts. Over the central area extend clear-cut lines of opaque white, running longitudinally but not quite regularly or quite continuously. Round spots of dark crimson-lake are sparsely distributed over the same area. The foot &c. are quite white but for a row of these spots along the side.”

The preserved specimen is high and rectangular in shape, 6.5 mm. long, 3 mm. broad, and 2.7 mm. high. The ample mantle-margin, long tail, and lines on the back are still noticeable. The other markings have disappeared.

The labial armature consists of a ring (which is broken or incomplete) formed of bifid, slightly bent rods. The formula of the radula is about  $33 \times 35 \cdot 0 \cdot 35$ . The innermost teeth almost meet across the rhachis ; they are stout and rather flat, with about 6 denticles outside, and on the inside a shoulder bearing 2-3 denticles. The second and third teeth are also stout and flat. The subsequent teeth become more slender and erect, with 8-10 distinct denticles. The outermost are small and degraded with 4-5 denticles on the tip.

If allowance is made for the fluctuation in colour which is so common in *Chromodoris*, it seems permissible to regard this specimen as a rather pale

variety of *Chr. maculosa*\*, which has a yellow margin, opaque white lines on the back, purple spots, and 8 branchiæ with red tips. Its buccal parts are unknown.

It is also very probable that this specimen is a colour variety of one of the species described by Rüppell or Ehrenberg from the Red Sea.

#### CHROMODORIS PALLIDA (*Rüppell & Leuckart*).

(*Doris pallida*, Rüppell & Leuckart, Neue Wirbellose Thiere des Rothen Meeres, 1828, p. 32.)

*Chr. marginata*, Pease, Proc. Zool. Soc. 1860, p. 30; and Bergh, 'Siboga'-Expeditie, 1905, p. 150.

*Chr. inornata*, Pease: Amer. Journ. of Conchol. vol. vii. i. 1871 p. 18; and Bergh, Mal. Unters. in Semper's Reisen, Supp. i. 1880, p. 21.)

Two small specimens (about 9 mm. long and 6 mm. broad) collected by Mr. J. G. Logan of Suez. The notes merely say, "White markings with yellow border to mantle."

The preserved specimens are stoutly built, rather high and rectangular in shape, with a narrow mantle-margin. The ground-colour is greyish brown, but there is a whitish border to the mantle and a considerable amount of whitish colour on the dorsal surface. It is distributed over a large patch in the centre, which is connected by two stripes with a line running round the branchial pocket, and adjoins another patch of roughly triangular shape between the rhinophores. The branchiæ are 7 or 8, with a very distinct white stripe on the outside of the rhachis.

The labial armature is strong and is formed of bent rods with a small denticle below the tip, so that from some points of view they look bifid and from others entire. The radula is long and narrow with a formula of about  $150 \times 30$ . F. 30, where F is a median "false tooth." The outline of its sides and apex is clear and well defined, but the base is indistinct. The three teeth nearest to the rhachis are rather broad and flat. The one next to the median "false tooth" is as usual in the genus and bears about 4 denticles on the inner side. The remaining teeth are hamate, strongly bent, and generally bear 8 denticles, sometimes 9 or 10.

These specimens are almost certainly the same as the animal identified by Bergh with *Chr. marginata*, Pease (1860), but are also probably identical with the much older (1828) *Doris pallida* of Rüppell & Leuckart, which was found in the Red Sea. *Chr. inornata*, Pease, is another closely allied form.

\* Pease's references (*l. c.* pages 15-16) to the figures in his plate seem to be wrong. Figs. 1*a*-1*d* are clearly the animal described as *Chr. maculosa*, and 2*a*-2*c* the animal described as *Chr. variegata*, but the numbering has been accidentally transposed.



*CHROMODORIS INORNATA*, Pease.

(Pease, Amer. Journ. of Conchol. vol. vii. i. 1871, p. 18; and Bergh: Mal. Unters. in Semper's Reisen, Suppl. i. 1880, p. 21.)

One specimen. The living animal was about  $1\frac{1}{2}$  inches long, rather narrow in shape but flattish with an ample mantle-margin, behind which the foot projected for some distance. The texture was very soft and delicate; the gills small. The colour was a rather translucent white with oval spots of dark violet; the mantle and foot were edged with bright yellow, and the rhinophores and branchiæ were also bright yellow.

The preserved specimen is much bent, but apparently about 18 mm. long and 6.5 mm. broad. The gills are 12 in number or perhaps 11, one plume being bifid. The labial armature is a complete distinct ring composed of bent rods, bifid at the tip. The radula consists of about 70 rows containing 40-50 teeth on either side of the rhachis. The innermost and outermost teeth have the structure usual in the genus. The innermost bear 3-4 denticles on the side next to the rhachis. The remaining teeth are tall, erect, and bear six very distinct denticles rather high up.

This seems to be the *Chr. inornata* of Pease and Bergh, and is possibly a variety of the last species.

*THORUNNA FURTIVA*, Bergh.

(Bergh: Mal. Unters. in Semper's Reisen, Heft xiii. 1878, p. 575.)

One specimen dredged in three fathoms, near Engineer Island, Khor Dongola, on a sandy bottom yielding sponge, weed, and polyzoa.

The living animal was shaped like a *Chromodoris*, and of a pinkish-white colour with a narrow border of bright yellow running round the mantle. The gills had each a strip of vermilion on the outer side, and the rhinophores were tipped with the same colour.

The preserved specimen is 8.5 mm. long and 3.5 mm. wide. It is greyish yellow with a vivid white border, and has all the external characters of a typical *Chromodoris*. The rhinophores are exerted and very large; the branchiæ retracted into the pocket and apparently 11 in number.

No trace of a labial armature was found, and its absence seems certain. The radula is very small and has a formula of about  $25 \times 20.0.20$ . The teeth are as described and figured by Bergh. The innermost are large and bear near the tip 4-5 denticles which are difficult to see, since in the preparation made of the radula the teeth present themselves vertically to the observer. The remaining teeth are tall and slender, bifid at the tip but not otherwise denticulate. The second tooth is larger than those which follow it.

This is undoubtedly Bergh's *Th. furtiva*. Its appearance when alive is now described for the first time.

PLATYDORIS INCERTA, *Eliot*, juv.

(Eliot: Proc. Zool. Soc. 1903, vol. ii, p. 378.)

One small specimen. Locality not mentioned. The notes on the living animal are as follows:—

“Found on a smooth leafy sponge of a grey-green colour. The nudibranch is of very nearly the same tint, except for a slightly wavy brown line from between the rhinophores nearly to the gills. Gills five, small, bipinnate: their pinnules are of a darker grey than the body. The perfoliated parts of the rhinophores are yellowish brown.

“Foot broad: grooved and notched in front. Oral tentacles distinct and fairly long.”

In the preserved specimen the rhinophores are retracted and the pockets are large holes with edges not much raised. The branchial pocket is stellate. There is no labial armature. The radula consists of 60 rows, containing 20–30 teeth on each side of the rhachis. The teeth are hamate, colourless, and increase in size as they are further from the rhachis. The outermost are degraded but not denticulate. The vas deferens bears a thick armature of spines on stout bases, of the type characteristic of the genus.

These specimens seem to belong to *Pl. incerta* described by me from Zanzibar, which is probably the young of some other species.

DISCODORIS AMBOINENSIS (?), *Bergh*, juv.

(Bergh: Mal. Unters. in Semper's Reisen, Heft xvii. 1890, p. 895.)

One specimen unaccompanied by notes. It is flat, 21.5 mm. long, 18 mm. broad, and the shape and external characters are as usual in the genus. The rhinophore pockets are slightly raised and the branchial pocket is crenulated. The branchiæ are five or six. The back is granulate or papulate, yellowish brown with darker mottlings. The coloration of the under side is similar, but the mottlings are concentrated in more distinct purplish spots. The labial armature is an incomplete ring composed of yellow rods. The formula of the radula is about  $26 \times 40.0.40$ . The teeth are of the ordinary hamate type: the outermost are small and slender but not denticulate. The genitalia are not armed in any way.

This appears to be an immature *Discodoris*, perhaps *D. amboinensis*.

Another small *Discodoris* from Dongonab was received, in a slimy and semi-decomposed condition. The entire mantle-margin had been cast off by autotomy and remained as a separate complete ring. The animal is perhaps a young specimen of *Discodoris fragilis*, Alder & Hancock.

## KENTRODORIS LABIALIS, sp. nov.

(? = *Doris setosa*, Pease, Proc. Zool. Soc. 1860, p. 26.)

Two specimens which though somewhat different in appearance were correctly referred by Mr. Crossland to the same species. Of the first, which was found under a stone on the mud-flats of Suez, he says:—"Dirty white, with inconspicuous round light brown spots which look like pits, but are not. Back covered with bundles of hairs (? spicules) which form a fringe to mantle and gill-pocket. Back rounded; foot narrow, deeply grooved and notched; oral tentacles finger-like." The second was found at Suakim on a shell of *Margaritifera vulgaris* attached to a buoy. Mr. Crossland says of it:—"Not very like the first specimen except for the tufts of hair-like spicules which cover it. Colour a very dark dull grey with sandy spots round mantle-edge and on the rhinophores and tips of gills. Gills long and rather slender, resembling those of a Chromodorid, but bipinnate, with numerous delicate branchlets."

Both specimens, as preserved, are much contracted and rolled up into balls, though they appear to have been naturally flat. The largest is about 12 mm. long and 7 mm. broad. The mantle-margin is ample. The pockets of the rhinophores and branchiæ are not raised. The back is covered with fusiform tubercles, somewhat swollen below the tips. The whole dorsal surface is full of spicules, which project freely from the tips of the tubercles. The spicules are fairly straight, not branched, and have a granulated appearance externally. The branchiæ are completely retracted; at least 8 in number, and possibly 10, two plumes being very small. The foot is narrow, with a rather long free tail. The anterior margin is deeply grooved; the upper lamina is notched in the middle and forms two ample lappets.

The blood-gland is purplish. The central nervous system is enclosed in a capsule which is spotted with purplish brown. Within the capsule are three pairs of fairly distinct yellow ganglia. The eyes are large and sessile with yellowish lenses.

A small labial armature consisting of fibrous-looking rods, somewhat swollen at the tips, was found. In both specimens it appeared as two plates, but they possibly represent a semicircular armature broken in two. The formula of the radula was in one specimen  $20 \times 18.0.18$ , and in the other  $24 \times 18.0.18$ . Some of the rows were shorter, but none contained more than 18 teeth. The teeth are simply hamate and erect, without a trace of denticulation. The innermost are hard to see, but apparently do not differ from the others in shape. The teeth increase in size from the inside outwards but the tips are often broken, which gives the row an irregular appearance. The outermost teeth are smaller and slender.

The hermaphrodite gland forms a white layer on the liver. The genitalia seem to be immature, and it is probable that the specimens are not full-grown,

but the verge bears a long, curved, pointed, colourless stylet, which seems to be enclosed in a special sheath.

These specimens resemble *Kentrodoris* (especially *K. maculosa*) in most characters—the texture, the lappets formed by the margin of the foot, the stylet, and the short radula—but they differ in having a small but distinct labial armature. This brings them near *Audura*, but *Audura* has a different texture and denticulate teeth. They seem to be midway between *Audura* and *Kentrodoris*, but closer to the latter, to which they are here referred, the principal specific characters being the labial armature and the long slender branchiæ.

It is extremely probable that this form is the *Doris setosa* of Pease, but Pease gives no account of the mouth parts or genitalia, and his figure does not show the lappets of the foot or agree in all the details of coloration. The identity cannot therefore be regarded as established.

#### PERONODORIS, Bergh.

(Bergh : Malac. Unters. in Semper's Reisen, VI. i. 1904, p. 44, ff.)

It appears to me that the genera *Peronodoris*, Bergh, *Halgerda*, Bergh, *Dictyodoris*, Bergh, *Asteronotus*, Bergh, and *Sclerodoris*, Eliot, are more nearly allied than appears from Bergh's classification, in which they are arranged under three subfamilies—the first in Archidorididæ, the second in Dialulidæ, the third and fourth in Platydorididæ. They are all characterized externally by the presence of ridges on the back, but except for these ridges the skin is smooth or minutely granulated, not villous or papillate and not regularly tuberculate, although there may be tubercles on the ridges (especially at the points of junction) or more rarely separate tubercles near the ridges. The internal organs are much as in *Archidoris*. There is no labial armature; the teeth rarely bear any denticles and the genitalia are not armed with hooks or spines. They show, however, a tendency to develop a stylet, in *Peronodoris* on the end of the verge, in *Asteronotus* near the female orifice.

The genera and species may perhaps be tabulated as follows :—

#### A. No armature on the genitalia.

- I. *Halgerda*, Bergh. Texture not hard or rough but leathery, or in some species like a stiff smooth jelly. Branchial pocket roundish. External teeth of radula sometimes pectinate.
  1. *H. formosa*, Bergh.
  2. } *H. apiculata*, Alder & Hancock.
  3. } *H. punctata*, Farran. These two species are probably identical.
  4. *H. (Dictyodoris) tessellata*, Bergh.
  5. } *H. wasinensis*, Eliot.
  6. } *H. (Dictyodoris) maculata* (Eliot). This species is probably the young of the last.
  7. } *H. willeyi*, Eliot, 1903.
  8. } *H. graphica*, Basedow & Hedley, 1905. These two species are probably identical.
  9. *H. elegans*, Bergh.

10. *Halgerda rubra*, Bergh. (= *Sclerodoris rubra*, Eliot.)  
 11. } *H. inornata*, Bergh, 1905.  
 12. | *H. coriacea* (Eliot) 1903. These two species are probably identical.
- II. *Sclerodoris*, Eliot. Texture hard and rough, much as in *Platydorid*. Branchial pocket with lobes or teeth. External teeth of radula not pectinate in known species.
1. *Sc. tuberculata*, Eliot.
  2. *Sc. osseosa* (Kelaart).
  3. *Sc. minor*, Eliot.
- B. An armature on the genitalia.
- III. *Peronodoris*, Bergh. Body rather hard. Branchial pocket toothed or tuberculate. Inner teeth of radula sometimes with a few denticles. A stylet on the verge.
1. *P. cancellata*, Bergh.
  2. *P. denticulata*, sp. nov.
- IV. *Asteronotus*, Ehrenberg. Large animals with a texture resembling *Halgerda*. Branchial pocket strongly toothed. Teeth of radula not denticulate. Glandula et hasta amatoria near the female orifice.
1. } *A. hemprichi*, Ehrenberg.
  2. } *A. cespitosus* (von Hasselt).
  3. } *A. mabilla*, Bergh. These three species are probably varieties of one form.

In the above arrangement I have regarded *Dictyodoris* as identical with *Halgerda*, and I doubt if my genus *Sclerodoris* will prove valid. After creating it I withdrew it as probably equivalent to Bergh's *Peronodoris*, which has priority. But perhaps it may be well to retain it provisionally. The stylet of *Peronodoris* is a more important character than an armature of spines and scales, which are little more than a thickening of the skin, for it represents more than they do the development of a new organ. Also the harsh rough texture of *Sc. tuberculata* and *Sc. osseosa* seems to me quite different from the texture of *Halgerda*.

I regard my *Sclerodoris rubra* as certainly the same as Bergh's *Halgerda rubra*, and my *Sc. coriacea* as being probably his *Halgerda inornata*. In excluding these species from *Halgerda* I was influenced by Bergh's definition of the genus in the 'System der Nudibranchiaten Gasteropoden' (. . . Tentacula parva . . . podarium sat angustum. Dentes pleurales extimi apice serrulati). But if that definition is made more elastic, I see no reason why these forms should not be included in *Halgerda*, except that my specimen of *H. rubra* has a hard rough torch unusual in the genus.

This group of Dorids runs into *Staurodoris* on the one side, for it is very hard to draw a line between forms which are typically tuberculate but have the tubercles connected by ridges, and forms which are typically ridged but develop tubercles on the ridges. On the other side the group runs into *Platydorid*, such a form as *Hoplodoris* being intermediate between that genus and *Asteronotus*.

## PERONODORIS DENTICULATA, sp. nov.

The notes on the two living animals are as follows :—(1) “Regular oval shape ; high back. Very sluggish. The back is ridged all over, more or less in a network pattern, but the main lines are one longitudinal mid-dorsal and others running out laterally. Six gills, bipinnate, small, sparsely and irregularly branched, grey but bright light yellow in the distal parts. Rhinophores of the same colour. Gill-pocket with six teeth, of which the posterior is much the largest. Measurements  $1.3 \times 1.0$  cm. General colour a cool grey, formed by specks on a whitish ground, and there are small white dots scattered about. The ridges are of a darker tint, more of the grey specks being present on them, and at intervals are raised into small light yellow warts which are especially well developed where two of the ridges meet or cross. Found by diver, Suakim Harbour, one or two fathoms.”—(2) “Picked up from the deck after divers had brought in a quantity of coral. In many respects like the preceding specimen, *e. g.*, in having a raised network and warts, though the arrangement of the ridges is not so regular. The gills also correspond. Body rather stiff and leathery, but not harsh to the touch : like india-rubber. Foot narrow. Animal fairly active. Oral tentacles long. Ground-colour a mixture of grey, light and dark brown, and yellow, the brown being confined to the visceral mass ; at junction of this and the mantle are large oval brown spots, four on the left, two on the right side. Under side yellowish white with specks of brown. The raised network and the warts are yellow.”

The preserved specimens agree fairly well with the above description. The edges of the rhinophore pockets are slightly raised and bear short irregular processes. The branchial pocket is also slightly raised and partially closed by not very distinct tubercles. The anterior margin of the foot is grooved, but it is not clear if the upper lamina is notched. The oral tentacles are short, stout, and distinct.

The blood-gland is greyish, thin and shadowy. The central nervous system is strongly granulated and distinctly divided into two halves, each half being less distinctly divided into three ganglia. The salivary glands are short and rather thick. The formula of the radula is in one specimen  $32 \times 30.0.30$  in the longest rows, and in the other  $28 \times 28.0.28$ . The teeth are hamate and increase in size outwards. The innermost have long bases and low hooks ; those in the outer third of the row are large and stout ; the last three are smaller but not denticulate, though sometimes jagged. A few of the inner teeth (in one specimen the first four counting from the rhachis, in the other the first six or seven) bear one minute denticle, more rarely two, on the outer side. The tooth next to the rhachis has also a denticle on the inner side. The denticles are larger in one specimen than in the other. No labial armature was found. The vas deferens is short and unarmed. The

penis terminates in a yellowish slightly bent stylet, exactly as in Bergh's figures of *Peronodoris cancellata*. The spicules in the integuments are not branched, but sometimes bent and jointed.

These specimens clearly belong to *Peronodoris*, and might be identified with *P. cancellata* but for the presence of a few denticles on the inner teeth. Also the branchial pocket is toothed.

*ASTERONOTUS HEMPRICHI*, *Ehrenberg*.

(See Eliot, Proc. Zool. Soc. 1903, vol. ii. p. 384.)

One very large specimen unaccompanied by notes. Even in its preserved and bent condition it is 130 mm. long and 100 mm. broad. The general colour is olive-green but the larger warts are bluish. There is a distinct median ridge. The branchial pocket is closed by six very distinct teeth, but the whitish branchiæ can be seen through them at the bottom. There is a very broad and distinct chocolate band on the under side of the mantle.

I doubt if the species of *Asteronotus* which have been described are more than varieties, and *hemprichi* certainly has priority as a specific name. The present specimen comes nearest to *A. cespitosa* (Van Hasselt), if that form is recognized as a valid species.

*ARTACHÆA CLAVATA*, *Eliot*.

(Eliot, in Journ. of Conchology, 1907, p. 81.)

One specimen. The notes merely say that it came from Engineer Island and was a "grey-brown dorid with warts and chocolate blotches under the mantle." The internal characters and, in essential points, the external characters leave little doubt that it is *A. clavata*, but superficially it is not like the specimens previously found in Zanzibar and resembles rather Bergh's figure of *Phialodoris podotria* ('Malacologische Untersuchungen,' in Semper's Reisen, Heft xvii. 1890, pl. 85. figs. 5, 6). The ground-colour is greyish white covered with low warts of a brighter white. The interstices between these warts bear mottlings and also dots of chocolate, and the whole dorsal surface displays a reticulate or stellate pattern formed by spicules radiating from the warts. This pattern is even clearer on the under side of the mantle. The rhinophores and branchiæ are both large and remarkably transparent and delicate. The labial armature, radula ( $20 \times 50 . 0 . 50$ ), and genitalia are as described for *Artachæa clavata*, l. c.

*ARTACHÆA VERRUCOSA*, sp. nov.

(? = *A. rubida*, Bergh, "Beiträge zur Kenntnis des Japanischen Nudibranchien, II.," in Verh. der k.-k. zool.-bot. Gesellschaft in Wien, 1881, p. 231.)

The notes on the living animal are as follows:—

"Three specimens, one from 5, two from 10 fathoms in Suez Bay. 3 cm. ×

1.3 cm. Of the typical shape, neither flat nor high, soft but firm in texture. Gills six, rather small, tripinnate, completely retractile; pockets drawn out transversely and anterior lip trilobed. Foot in crawling moderately broad, but becomes very narrow when the beast is laid on its back.

“Of somewhat varying colour. One specimen is on the whole brown; another grey with but little brown; the third intermediate between the two. The back is quite covered with warts, round and of different sizes. They are light brown, mottled with opaque white or light drab. The narrow spaces between the warts are brown, with more or fewer chocolate marks. The depth of this colour varies in different parts, so that the body is mottled grey and brown.”

The preserved specimens correspond fairly well with this description. The anterior margin of the foot is grooved and the upper lamina notched. The rhizophore pockets are protected by two not very conspicuous valve-like tubercles, between which on both sides are a number of small tubercles. There are also tubercles on the rim of the branchial pocket, but though distinct they are not specially modified.

The integuments are not very hard, but full of white spicules, fairly straight but often jointed or broken. The liver and other internal organs are brown or grey of various shades. The blood-gland is large, thick, and greyish white. The central nervous system is granular and somewhat concentrated, the two sides as well as their component ganglia being close together. The division between the cerebral and pleural ganglia is not clear. The pedal ganglia are set on a distinctly lower level, somewhat at the sides of the œsophagus.

In the two specimens dissected no trace of a labial armature was found. In both the radula is somewhat crowded and disordered. It consists of 25 rows in one specimen and of 27 in the other. In the first the number of teeth on each side of the row does not much exceed 40; in the other it is as much as 55 in some rows. There is no central tooth. The first lateral is rather broader than the others and bears three or four denticles on both sides. These denticles are rather irregular and extremely difficult to see, as the tooth stands vertically and I was not successful in obtaining a side-view, but their presence is certain. About the ten outermost teeth bear a variable number (5–12) of very irregular small denticles on the lower side of the hook. The remaining teeth are apparently smooth and simply hamate. The outermost six teeth or so are thinner than the others and sickle-shaped, with smaller bases. This formation is more conspicuous in one specimen than in the other.

On issuing from the buccal mass the œsophagus is about 1 mm. broad, but it expands shortly afterwards into a dilatation about 4 mm. long and 3 mm. broad. After this it again contracts to its original dimensions and runs into the liver. There is no stomach outside the liver, and it would appear that



the liver-cavity acts as a stomach. The liver, though, as usual in Dorids, forming one mass, is very loose and easily falls to pieces.

The hermaphrodite gland forms a very thin layer spread over the liver. The penis is armed with hamate spines arranged in rows but apparently not extending to the vas deferens.

I do not see how this form can be identified with Bergh's *A. rubida* on account of the very distinct difference in the inner teeth. There are also minor discrepancies, *e. g.* in *A. rubida* the anterior margin of the foot is said not to be clearly grooved. But the two species are nearly allied.

Four more specimens from Dongonab were subsequently received from Mr. Crossland in February 1898. They are about 35 mm. long and 17 mm. wide. Three are flat, rather soft, with broad feet expanded into thin margins; the fourth is harder, more convex, and the foot is narrower. The colour of all is orange-brown of various shades. The pigment is distributed chiefly between the warts in a reticulate pattern and is darker in some places than others, producing an impression of blotches. The warts are sometimes plain grey and sometimes bear 1-3 brown dots. The branchiæ are 6-7, rather long and thin and usually only bipinnate, though tripinnate plumes also occur. No labial armature was found, but in one specimen the labial cuticle bears a patch of granules or very minute rods not connected into a plate. The radulæ are about  $60 \times 30 \cdot 0 \cdot 30$ . The three or four denticles on the innermost teeth are very clear and distinct, but the small denticles on the outer teeth are inconspicuous and seem to be reduced to minute ridges.

#### DORIDOPSIS RUBRA (*Kelaart*).

(See Eliot, in Proc. Zool. Soc. 1904, vol. ii. p. 279.)

The notes on the living animals are as follows:—

“(a) In tidal stream of salt water near the canal. Exactly like a Dorid in shape, but rhinophores are not retractile into pockets but merely shrink into shallow depressions when touched. There is a shallow gill-pocket, but the gills are not retractile into it. They are five, bipinnate, and set in a circle open behind. There are no proper oral tentacles; in their place is a pair of dull yellow, slightly projecting flaps. Colour, a transparent pink, but dorsally this is hidden except at margin and tips of rhinophores by sooty pigment evenly distributed, but also found in denser irregularly scattered blotches. Under surface of foot pink.

“(b) Later from the same locality, two more specimens; more pink, *e. g.* rhinophores quite red with white tips. Rhinophores and gills can be retracted a good deal when the animal is lively, but far from being put out of sight. Largest specimen measures 3·8 cm.  $\times$  1·7 cm. and foot projects a little behind the mantle.

“(c) Kal el Kebira shoal in Suez bay, among corals. A good-sized specimen in which the gills and rhinophores were completely retracted.

“(d) Reef-edge of Tella Tella Kebira, an island of the Suakim group. Gills tripinnate, not retracted. Rhinophores partially retracted. Colour red, with mottlings of brown dorsally.”

All these specimens seem to be *Doridopsis rubra*. In those dissected the œsophagus (as seen dorsally) turns to the right and then forward, describing a complete loop and passing under itself. Close to this point are the small but distinct salivary glands. After describing the loop the œsophagus gradually dilates and runs backwards, tending somewhat to the left until it enters the liver. In specimens from other localities which I have examined the œsophagus though bent does not form a complete loop.

The interest of these specimens lies in the fact that they offer a series of stages in which a normally cryptobranchiate Dorid becomes almost completely phanerobranchiate. There can be no doubt of the reality of the phenomenon, for it is vouched for by Mr. Crossland's notes on the living animals as well as by the condition of the preserved specimens. In many species of *Doridopsis* the branchiæ are habitually everted and not easily retractile into the pocket. This seems to be due to the thinness of the integuments. A hard and thick gill-pocket forces the visceral mass to find room for it, but when the integuments which form and surround the pocket are thin membranes, the visceral mass tends to expand beneath it and to press its floor upwards. The branchiæ are thus driven outwards, and doubtless the more they are exposed the harder, thicker, and larger they grow, and therefore it is more and more difficult to find room for them in the delicate pocket which gradually becomes disused and atrophied. In one of the present specimens there is no sign of the pocket except an inconspicuous circular fold of skin running round the base of the stout branchial plumes. The rhinophore pockets, though plain in some specimens, seem to have altogether atrophied in others.

It seems natural to suppose that the phanerobranchiate condition is the more primitive and that the branchial pocket is a later specialization, but these specimens indicate that in some cases at any rate variation may take the opposite direction and that cryptobranchiate forms may become phanerobranchiate.

#### DORIDOPSIS NIGRA (*Stimpson*).

(See Eliot, Proc. Zool. Soc. 1904, vol. ii, p. 275, and authorities there quoted.)

Several specimens from the mud-flats near Suez, where the animals were found under stones and in the cavities of a red sponge which they probably eat. They were also found with orange-coloured egg-ribbons which they had probably laid. All the specimens appear to belong to the smooth black variety, which has no spots but a light border round the mantle and foot.

In some there was, according to Mr. Crossland's notes, a distinct orange border; in others only a little whitish or reddish colour near the mantle-edge. The living animals are said to have attained a length of 8 cm., but the preserved specimens have shrunk considerably. The anatomy of those opened proved to be as usual in this species.

*DORIDOPSIS* sp.

The notes on the living animal are as follows:—"When actively crawling, peculiarly elongated, measuring 4 cm. by 1.2 cm. The wavy mantle-edge is kept applied to the substratum. Rhinophores straight, perfoliated half their length, basal part thick. Gills small and sensitive, rarely seen, tripinnate, 4 (?) in number, white with grey rhachis. The gill-pocket is generally closed and its place marked by wrinkles. The rhinophores also are completely and readily retractile. The mantle is moderately ample. The general texture is soft but firm. The colour is translucent white with large and small spots of opaque white (which are thickened places in the skin) and sooty spots of black like fallen smuts. The viscera show through as bright pink."

The animal as preserved was shrunken and hardened, but the buccal parts seemed to be as in *D. nigra*.

This may be *Doridopsis atromaculata* but no dorsal papillæ are mentioned, nor are they visible in the preserved specimen. It may also be *D. bataviensis*.

*PHYLLIDIA VARICOSA*, *Lamarck*.

(Bergh: Bidr. til en Monogr. af Phyllidierne, 1869, p. 500.)

The notes on the living animal say:—"On sand among coral at the edge of the shore-reef; seen at a depth of about a fathom and obtained by a diver. 6 cm. long and 3 cm. broad. Jet-black with raised warts of a dirty greenish white, which are very high and bear small secondary warts; the tops of these are brilliant orange. The rhinophores are also orange and were kept retracted though the animal was continually crawling. The largest warts are arranged one behind the other in five longitudinal rows down the back. From the outermost of these rows low bands of greenish grey bearing small warts go to the mantle-edge."

The orange tips are harder than the rest of the epidermis.

*Additional Note, received 23rd June, 1908.*

*MARIONIA CYANOBANCHIATA* (*Rüppell & Leuckart*).

(Rüppell & Leuckart: Neue Wirbellose Thiere des Rothen Meeres, p. 16, pl. iv. fig. 3, 1828).

One specimen found outside Dongonab harbour in one fathom of water crawling among pearl shells on a coral and mud bottom.

Mr. Crossland says of the living animal :—

“Length 45 mm., breadth of body 10 mm., total breadth (inclusive of appendages) 27 mm. Rhinophores as usual. Velum with five tentacular projections on each side, of which the middle one on each side is long, the outermost is spatulate. Body not so high and square in section as in *Tritonia*, lower and more rounded. Foot broad.

“The dorsal appendages are remarkably large ; there are 9 pairs, all of which are large except the hindmost. They increase in size from the head to the middle of the body, after which size remains practically the same with exception of the last pair. They are six times branched ; this complication of branching and their size and shape recall the gills of a *Dorid*.

“The normal position of the main stem is at 45° to the vertical, the smaller branches spread out more or less in one plane, and the plumes cover most of the back and all the space between consecutive appendages.

“Colour very striking. Body primrose-yellow, orange along sides of back. Thicker branches of gills also light yellow, but the finer branches are a light bluish green. This colour is also found on the velum and covers the rhinophores. On the middle of the back is a network of blotches of umber-brown.

“As the creature crawls the anterior appendages rhythmically bend over the back and then outwards ; the motion arises in the bases of the main stems, not by contractions of the dorsal body-wall.

“In spirit the back appears rather warty ; it was not so in life, and I do not know to what the warts correspond, possibly to yellow dots enclosed by the brown network.”

As preserved, the animal has entirely lost its beautiful colour and is of the brownish tint usual in alcoholic specimens, but traces of bright light yellow remain on the branchiæ.

The shape is as described by Mr. Crossland and also corresponds with Ruppell and Leuckart's figure. The foot, as preserved, is pointed in front with a line or very shallow groove on the anterior margin. The tail is short and hidden by the posterior branchiæ. The genital orifices are on the side, below and between the first and second branchiæ. The anus is latero-dorsal and lies just in front of the fourth branchia. The rhinophore-sheaths are rather tall, with wavy but not denticulate margins ; the club is surrounded by branched processes which adhere closely to it. The branchiæ look like small trees. There is at the base a thick, longish common stem ; this divides into three main branches, which are again subdivided into three, and these subdivisions are tripinnate. In all the plumes the division seems to be with few exceptions consistently tripartite.

When the animal is opened, the large heart and pericardium are conspicuous objects lying almost in the centre and only slightly to the right of the median line. The central nervous system is as depicted in Bergh's plates of

*Tritonia hombergii* ('Malacologische Untersuchungen,' in Semper's Reisen, pl. lxxiii, fig. 1).

The jaws are thin and transparent. No striation or tessellated appearance is visible. The edge bears a single row of large and distinct denticles. The radula consists of 49 rows with a formula of  $30 + 1 + 1 + 1 + 30$  as a maximum, but the rows in front are much reduced and the first consists of the median tooth only. The median tooth is broad and bears three cusps, but as the corners are also raised it might be called five-cusped. The central cusp sometimes bears an inconspicuous denticle on either side. The first lateral is as usual in the genus. The rest are simple, without denticles, and erect; the inner ones are rather thick; those nearer the end of the row are much thinner and more elegant. The outermost of all is smaller and less well formed.

The œsophagus is short. The first division of the stomach is lined with folds, which are stronger in the anterior than in the posterior part; the second division is armed with a belt of about 70 roughly triangular horny plates, striated and of different sizes. The intestine is broad and laminated internally. The liver is greenish yellow inside, but greyer outside owing to the layer of the hermaphrodite gland which covers it. The front part is hollowed out and forms two lobes which enclose the greater portion of the stomach. The hepatic mass is traversed by large ducts which have the appearance of prolongations of the stomach. An accessory portion of the liver lies under the intestine. The genitalia are as usual in the genus. The spermatheca is empty and crushed, but apparently spherical. The vas deferens is white, much convoluted, but not very long.

This specimen may be regarded as certainly identical with the *Tritonia cyanobranchiata* of Rüppell & Leuckart, also found on corals in the Red Sea, but must be referred to the genus *Marionia* on account of the armature of plates in the stomach. The external characters and remarkable coloration agree fairly well with their plate and description except that the lower parts of the branchiæ are more decidedly yellow. It is possible that it is really only a highly coloured variety of *Marionia arborescens*, Bergh. There are considerable differences in Bergh's description of specimens referred to this form, but one of them ('Malacologische Untersuchungen,' in Semper's Reisen, p. 891) does not differ greatly from the animal here examined. It would seem that the Tritoniadæ of the Red Sea are more brilliantly coloured than in other parts of the Indo-Pacific.

The name *Marionia cyanobranchiata* has priority over *M. arborescens*, if the two prove identical. [C. E.]